T15D11 – HL Born-Haber Practice

Name……

1. The lattice enthalpy values for lithium fluoride and calcium fluoride are shown below.

LiF(s) $\Delta H^{\ominus} = +1022 \text{ kJ mol}^{-1}$

$CaF_2(s)$ $\Delta H^{\ominus} = +2602 \text{ kJ mol}^{-1}$

Which of the following statements help(s) to explain why the value for lithium fluoride is less than that for calcium fluoride?

I. The ionic radius of lithium is less than that of calcium.
II. The ionic charge of lithium is less than that of calcium.

A. I only
B. II only
C. I and II
D. Neither I nor II

(Total 1 mark)

2. Which reaction has the most negative $\Delta H^{\ominus}$ value?

A. $LiF(s) \rightarrow Li^+(g) + F^-(g)$
B. $Li^+(g) + F^-(g) \rightarrow LiF(s)$
C. $NaCl(s) \rightarrow Na^+(g) + Cl^-(g)$
D. $Na^+(g) + Cl^-(g) \rightarrow NaCl(s)$

(Total 1 mark)

3. Which is a correct equation to represent the lattice enthalpy of magnesium sulfide?

A. $MgS(s) \rightarrow Mg(s) + S(s)$
B. $MgS(s) \rightarrow Mg(g) + S(g)$
C. $MgS(s) \rightarrow Mg^+(g) + S^-(g)$
D. $MgS(s) \rightarrow Mg^{2+}(g) + S^{2-}(g)$

(Total 1 mark)

4. (a) The lattice enthalpy of an ionic compound can be calculated using a Born-Haber cycle. Using lithium fluoride as the example, construct a Born-Haber cycle, labelling the cycle with the formulas and state symbols of the species present at each stage.

(6)

(b) Two values of the lattice enthalpies for each of the silver halides are quoted in the Data Booklet. Discuss the bonding in silver fluoride and in silver iodide, with reference to these values.

(2)
(Total 8 marks)

5. (i) Define the terms *lattice enthalpy* and *electron affinity*.

(2)

(ii) Use the data in the following table and from the data booklet to construct the Born-Haber cycle for sodium chloride, NaCl, and determine the lattice enthalpy of NaCl(s).

$Na(s) + \frac{1}{2}Cl_2(g) \rightarrow NaCl(g)$ $\Delta H^{\ominus} = -411$ kJ mol^{-1}

$Na(s) \rightarrow Na(g)$ $\Delta H^{\ominus} = +108$ kJ mol^{-1}

(4)

(iii) Describe the structure of sodium chloride.

(2)

(Total 8 marks)